



"STANDARD OF CARE OF PERITONEAL DIALYSIS"

**DEPARTMENT OF
NEPHROLOGY**

RMLIMS



RMLIMS PD Working Group

- **Dr. Shivendra Singh**
DM (Nephrology)



- **Dr. Abhilash Chandra**
DM (Nephrology)



- **PD Nurse : Amit Sharma**



Foreword by Director

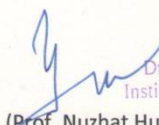
This is both an exciting and a challenging time for those of us in the healthcare sector. Kidney disease is exploding in India and other parts of the world, a concerning trend given the terrible impact that advanced kidney disease has on survival and quality of life.



I am disheartening to continue to find peritoneal dialysis the much neglected step-child in our country. There is a great deal of misinformation about the modality and a lack of expertise in this type of dialysis. Our patients are the losers as they often are not given a chance to consider this promising form of dialysis that allows the continuation of a more normal quality of life.

It has been clearly demonstrated that with modality education the outcomes of patient on dialysis improves significantly. Without an educational program, most patients simply default on their treatment.

A team approach is very much emphasized in peritoneal dialysis programs, with the peritoneal dialysis nurses key to a successful program. In our endeavor to improve the practice of peritoneal dialysis at our centre, we have come up with this handy booklet of “PD Protocol”. This booklet intends to be a roadmap for running a successful PD program at Dr. Ram Manohar Lohia Institute of Medical Sciences.

 **DIRECTOR**
Dr. Ram Manohar Lohia
Institute of Medical Sciences
Lucknow
(Prof. Nuzhat Husain)

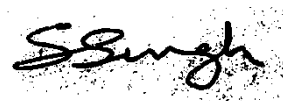
FOREWORD BY DR. SHIVENDRA SINGH

The burden of Chronic Kidney Disease is increasing in India with prevalence of approx 10% in general population. Majority of them will eventually develop end-stage renal disease (ESRD). Only 3–5% of all patients with ESRD in India get some form of renal replacement therapy (RRT). Continuous ambulatory peritoneal dialysis (CAPD) is one of the mode of RRT, was initiated in India in 1991. CAPD is simple home therapy with relatively few contraindications, yet the penetration of CAPD has been only 18-20% yearly in India.



In developing countries like India PD offers certain advantages over hemodialysis such as simplicity, reduced need for trained technicians and lack of electricity dependence. Nowadays percutaneous CAPD catheter insertion by nephrologists has also reduced hospital stay and cost for PD initiation. A recent report showed that only 2.3% of all catheter placements are performed by nephrologists.

The PD programme at our institute is running successfully with full government support for poor patients. With intention to promote PD programme and catheter insertion by nephrologists we have developed “PD protocol” which will be revisited annually for possible modifications and upgradations.



Dr Shivendra Singh
Head of Department
Dept. Of Nephrology
RMLIMS, Lucknow

Foreword by Dr. Abhilash Chandra

Kidney disease in India and other parts of the world is one of the most challenging disease having serious impact on survival and quality of life of patient.



Educational programm is keys aspect to improve the dialyses of patient also peritoneal dialyses which is one of the modality as RRT option has got the user friendly PD protocol to follow the key aspects of our endeavor to enhance the usage of successful PD programm in Dr. Ram Manohar Lohia Institute of Medical Sciences, Lucknow.

A handwritten signature in black ink, appearing to read 'Abhilash Chandra', with a textured, slightly grainy background.

(Dr. Abhilash Chandra)

Introduction

The PD working group of RML Institute of Medical Sciences, held a meeting in the department of Nephrology and has finalized the following protocols which shall be adhered to in the PD program. The group has kept in mind, the existing recommendations of international and national bodies in PD; and did our best to work and create guidelines within the recommendations. However, we feel that there would be regional differences and it is important to formulate local center specific guidelines to help achieve good results in the PD Program.

The following guidelines / protocols have been discussed and framed in 05 Jan. 2015. The protocols shall cover important aspects of care in the patient life cycle shortly before he comes onto PD and also once he is on PD.

Guidelines for Enhancing PD Outcomes

The guidelines have been designed to enable our center to deliver high class PD standards of care. The main areas of focus are:

1. Pre Dialysis Education
2. Pre Operative Protocols & PD Access
3. PD therapy training
4. Adequacy of Peritoneal Dialysis and Fluid Management
5. Management of Infectious Complications of PD

Goals of the INSTITUTE PD PROGRAM

By following the protocols we have set for the PD program,
we hope to achieve the following

Peritonitis rate: Our PD Program shall have a minimum peritonitis rate on **1 episode in 45 patient months** and in the coming years improve upon this to reach best figures in the country

Time On Therapy: We shall strive to reach a **TOT of minimum 10 patient months**. We set this as our initial target and shall use all medical means and resources to make this goal a reality.

The INSTITUTE PD working group shall reconvene in the month of Dec. on the 30 Dec. 2015 to review the results and goals of the PD program. We shall look for areas of improvement and create new benchmarks for our PD program. This will be a part of our constant endeavor to help better the lives of patients who are disabled by a chronic disease like CKD.

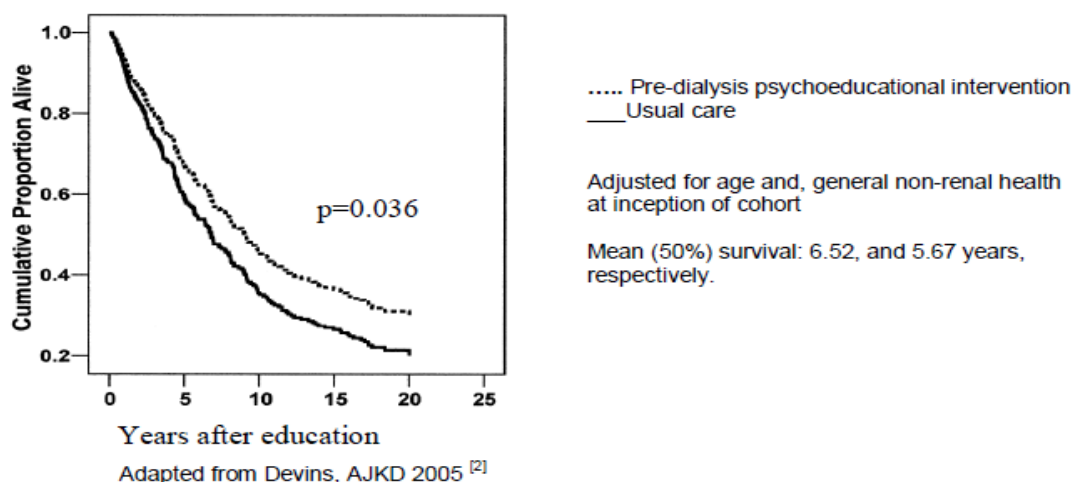
Pre Dialysis Education

The role of pre-dialysis education in ESRD*

Pre-dialysis education, aimed at educating ESRD patients about various aspects of renal replacement therapies, helps clinicians to involve patients as active participants in their healthcare, and reduces the risks for psychological depression which is associated with poor outcomes in dialysis.^[1]

Association between pre-dialysis education and patient survival

- In a multicenter, randomized controlled trial in which 335 CKD patients were followed for 20 years, it was reported that patient survival was significantly higher in patients who received structured pre-dialysis education, compared with those with usual care after initiation of dialysis.^[2]



- Other studies have also demonstrated a positive impact on survival, as well as a reduction in hospitalization need.^[3, 4]

1. KDOQI Clinical Practice Guidelines. Am J Kid Dis 2006; 48(Suppl 1): S91-175.
2. Devins et al, Am J Kid Dis, 2005; 46 (6): 1088-1098.
3. Ravani J Nephrol 2003;16:870-7.
4. Ravani J Nephrol 2003;16:862-9

“

The primary determinants of mode of initial Dialysis include the preference of a fully informed patient, absence of medical and surgical contraindications, and resource availability”

“ When dialysis modality is not determined by preference of a fully informed patient, absence of medical and surgical contraindications and resource availability, consider CAPD in preference to haemodialysis; to better preserve residual renal function and allow graded introduction to Dialysis”

CARI Guidelines. Nephrology, 2005; 10(Suppl 4): S58-S60.

ALLOWING PATIENTS A CHOICE

“Forcing suitable (or unsuitable) patients to home dialysis fails the test of improving outcomes and will not be less costly. Especially since patient compliance and motivation are key elements of success full home dialysis, forced patients will no doubt fail frequently, with death and / or expensive hospitalization and transfers to HD highly likely events”

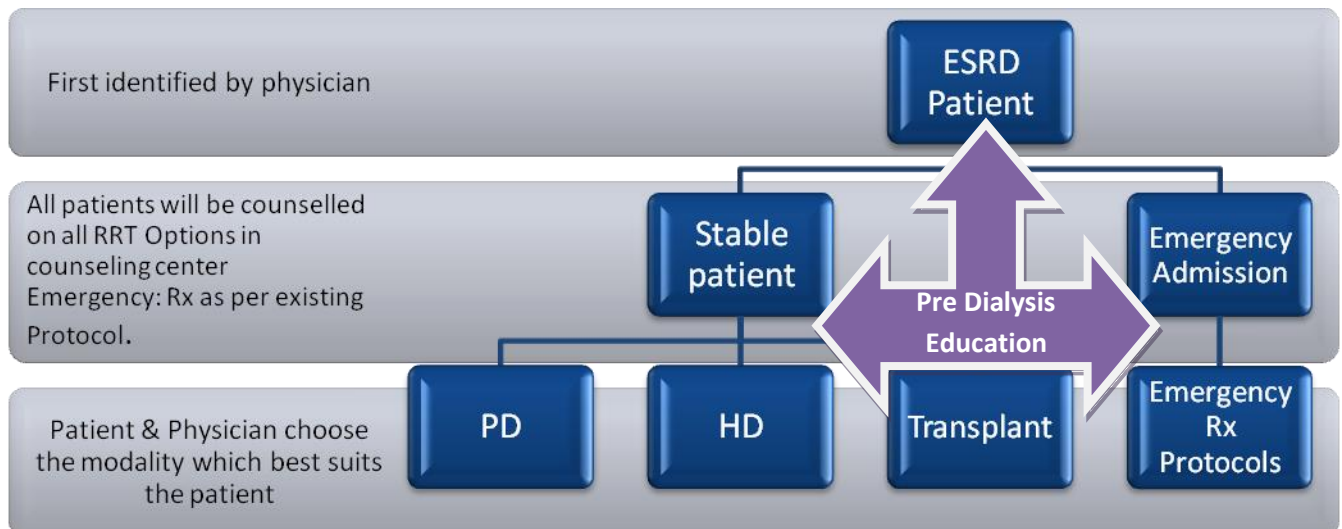
Mendelssohn et al. Nephrol Dial Transplant 2009; 24: 555-60.

“PD can be used in almost all clinical conditions. Accordingly, patient preference should play a more important role in the decision making process”

Couchoud et al Perit Dial Int, 2008; 509-17

ESRD Patient Flow Pathway

The pathway follows an integrated care model which allows for a best patient to therapy fit taking into consideration the medical and social conditions of the patient including patient preference. The pathway will further elaborate the patient care process flow for PD, which may be followed in case of patient choosing PD as the modality.

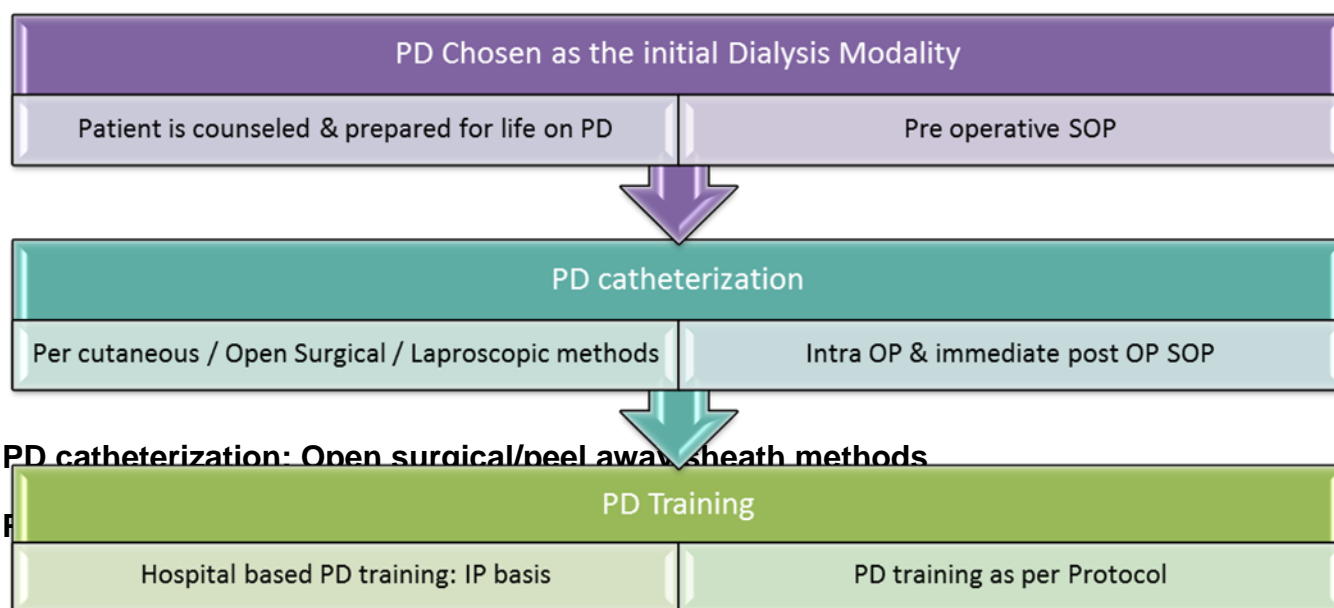


This model proposes the patient care pathway that can be followed in the pre dialysis stage. This model essentially emphasizes on patient education in the pre dialysis phase which has been proven to be associated with better patient outcomes.

Once the Initial Dialysis Modality has been chosen, the physician can institute patient care basis his / her experience or basis pre existent protocols of patient care.

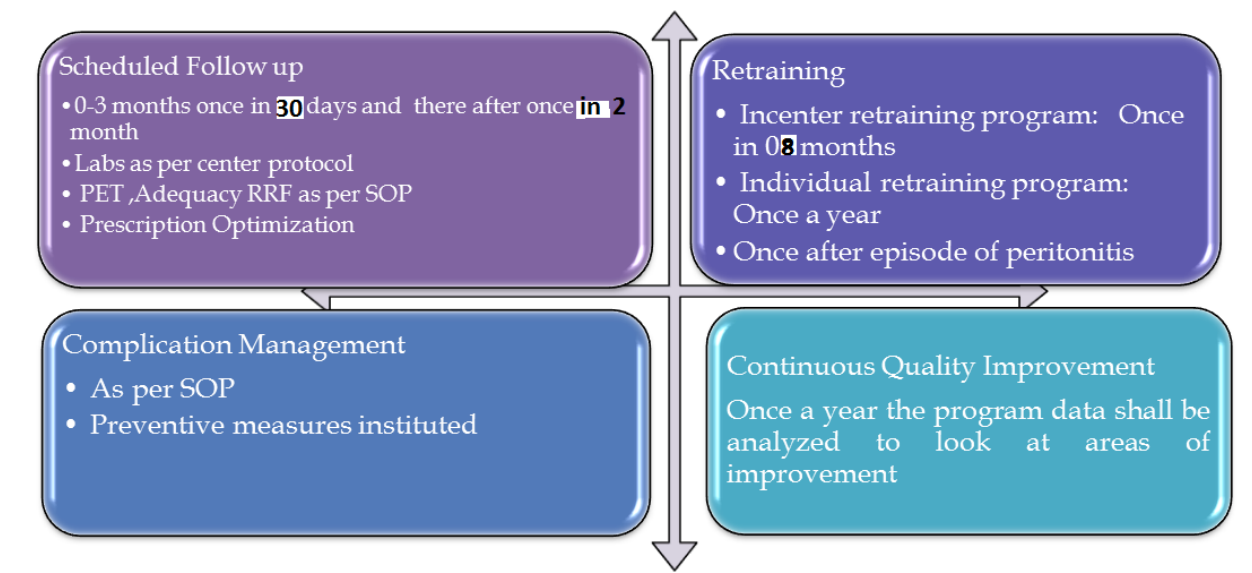
PD Patient Care Pathway

If the Initial modality chosen is PD, then the following is the patient care pathway that can be instituted for the PD program. This is a brief outline of the different phases in the patient life cycle on PD



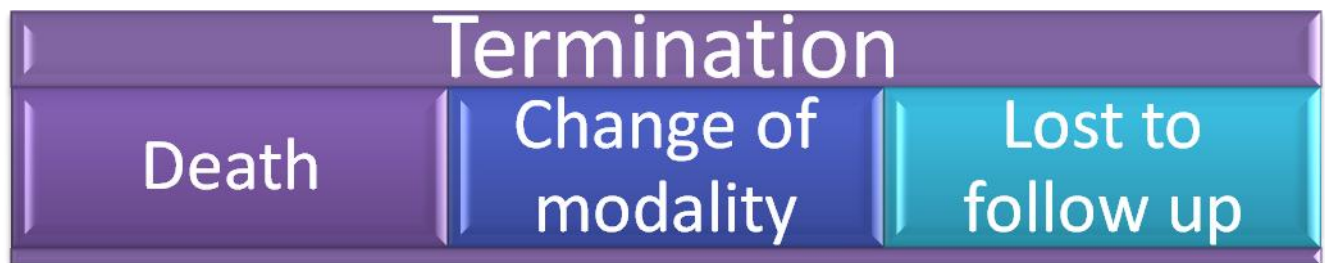
PD catheterization: Open surgical/peel away sheath methods

Different Components of follow up phase



All patients are followed up as per center protocols / SOPs and relevant data is collected and centrally maintained. Patient is followed up till termination.

Termination:



At the time of termination also all relevant clinical and demographic data is collected and centrally maintained.

All collected data is analyzed on a regular basis, i.e every 06 months if any change in protocols are initiated else once in every 12 months to check for areas of improvement. Once a year the PD team headed by the Program Director, shall convene to look at the analyzed data and to define any changes needed.

This process of CQI is a continuous and ongoing process, which will help improve program outcomes. This ultimately translates into patient benefit.

Scheduled Investigative protocol for PD Patient follow up:

- Monthly: Hb, electrolytes (1&2), urea, creatinine, T.protein (SGPT,SGOT- IF ON ATT)
- Once in 6 months: PET & adequacy, iPTH, VitD3

Frequency	Name of	Constituents	Optional tests
Monthly	PD 1	CBP,FBS/PLBS, Urea, Creat, Na, K, Cl, Sr. Alb	1. Iron Profile : Refractory anemia 2. Viral Screening: Post HD, Blood Transfusion
Bimonthly	PD 2	PD 1 + Ca, PO ₄ , 24 Hour Urine collection for volume & renal clearance, Vit D3 & iPTH	
Once in 6	PD 4	Lipid Profile, Adequacy (Kt/V)	
Half Yearly	PD 6	2D Echo	
Yearly	PD 12	PET	

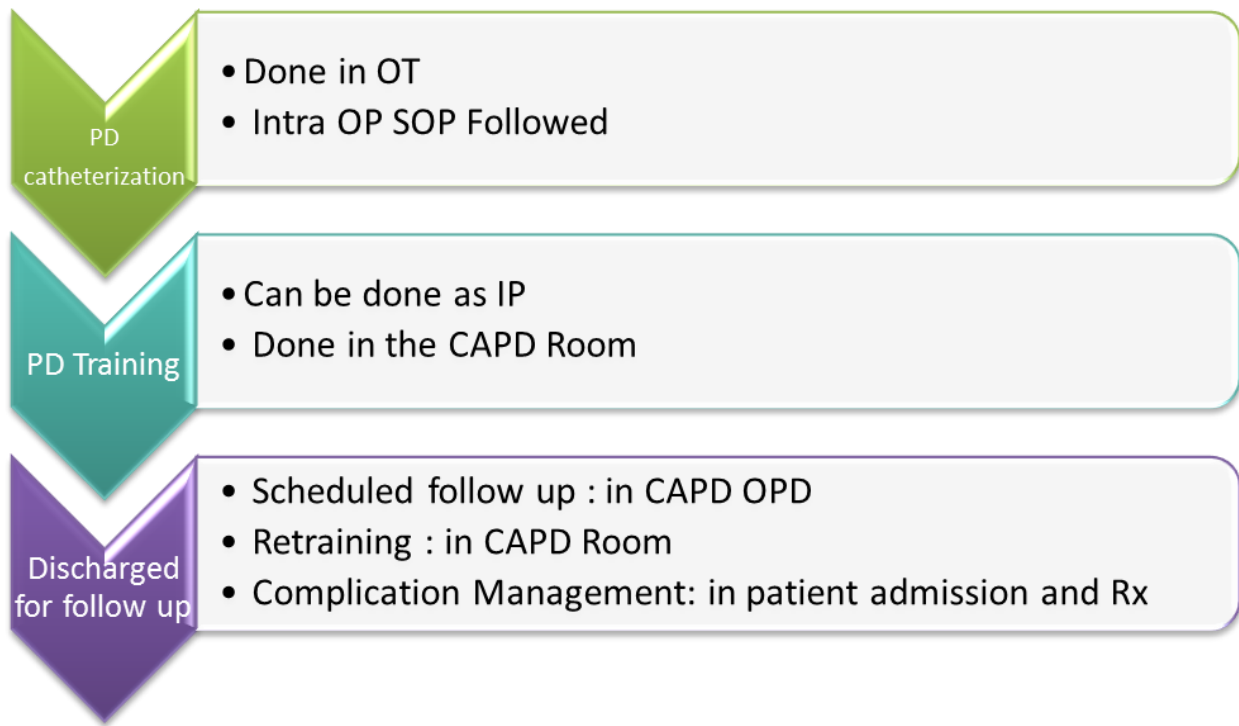
Patient Flow within Hospital in different Phases of the Patient life cycle on PD

PD cathterisation: done in OT/ bed side in MICU

PD Training: in IP basis only in PDCC

Discharged for follow up: Schedule follow up: in CAPD OPD

Retraining: in PDCC



Patient Flow in CAPD OPD: Dedicated OP weekly thrice:



- **Nursing station:** Exchange procedure, Exit site inspection, History taking.
- **Nephrologists:** clinical examination, patient review, Prescription Modification.
- In schedule follow up during the CAPD OPD the patients will also be followed by the nutritionist for the diet advise

In the scheduled follow up during the CAPD OPD the patients will also be counseled by the PD team in an effort at rehabilitation and increasing compliance

The above mentioned patient care pathway is a bird's eye view of how the program will run

INSTITUTE PD Program Pre, Intra & post operative Care

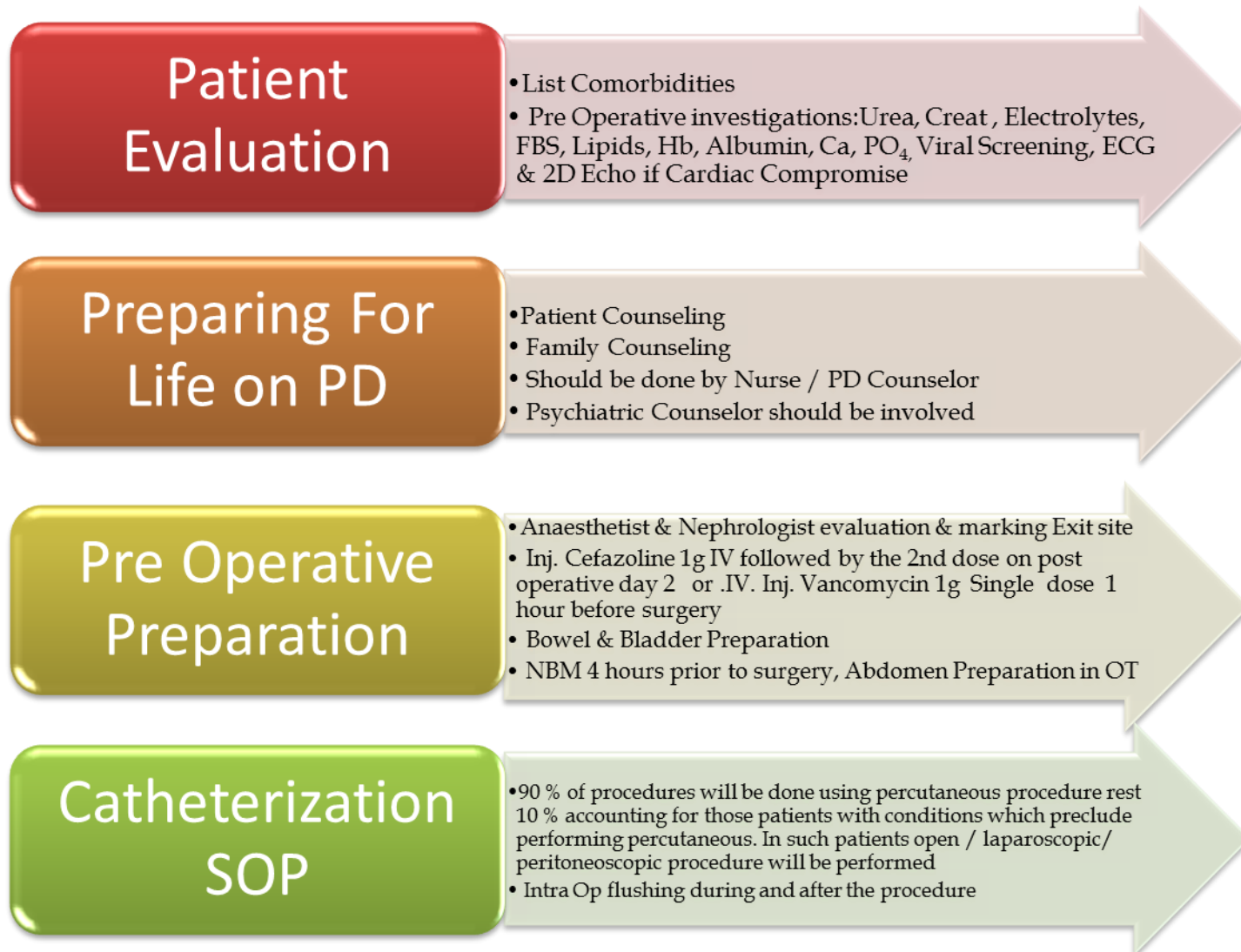
Pre & Intra operative Assessment:

- Pre-operative preparation: evaluation & marking of exit site by nephrologist, surgeon & PD nurse
- Inj. Amoxicillin Clavulanate IV single dose 1 hour before surgery
- Skin preparation, Bowel & Bladder preparation
- NBM from 4 hrs prior to catheterization

Abdomen preparation in OT/ bedside

- Catheterization SOP: 100% of procedure will be done by Surgical insertion.
- Peritoneal biopsy: HPE& EM will be taken
- Intra Op flushing during & after procedure.
- Patient mobilization: rest for 24hrs mobilization from after 24hrs

Flushing & Exit site care: strict aseptic technique will be followed.



Post-operative Care

- Flushing will be done from 48hrs, then weekly twice (with I.P heparin 1000IU/l)
- Inflow & outflow will be monitored.
- Exit site will be dressed with ointment Mupirocin
- Suture removal will be on 10th day.

- **Initiation of full volume PD prescription: In 2 weeks unless there is a need for emergency start**
- **Emergency start will be with low volume supine PD/ APD, fill volume will be 500ml**
- **Empirical prescription will be with as low glucose concentration as possible & according to the UF required.**

INSTITUTE PD Program: Patient Training

RATIONALE

Patient training is a mandatory component in a Peritoneal Dialysis Program. The International Society of Peritoneal Dialysis (ISPD) established and published the first set of ISPD recommendations for patient training in 2006¹. The ISPD Nursing Liason Committee suggests that training should continue until the PD trainer determines that the patient (at a minimum):

- Can safely perform all required procedures.
- Is able to understand the concepts of contamination and infection.
- Is able to provide appropriate responses to problems presented.

Hall et al in 2004² conducted a study to look at the effect of training methods on selected patient outcomes. The study showed that the use of principles of adult learning in a PD training program resulted in improved peritonitis rates, reduced dropout, improved fluid balance and improved mean compliance scores. The authors concluded that a well planned and thorough programme to improve learning efficiency while maintaining/encouraging flexibility to meet individual patient needs is a key element in improving outcomes.

RETRAINING

However, even good training is frequently not sufficient. The chronic nature of PD treatment allows for progressive modifications of how patients perform their exchanges³. Russo et al found that approximately one-third (29%) of patients needed reinforcement of knowledge and ability to correctly perform PD as related to infection control and 27% for the correct use of drugs.

Hence, a PD training programme should include an analysis of patient compliance over time, aimed at identifying areas in which re-training is required as this provides an opportunity for root cause analysis of a problem in an effort to prevent recurrence.

The ISPD committee recommends re-training after the following:

- Peritonitis
- Catheter related infection

- Prolonged hospitalization

RECOMMENDED OUTCOME ASSESSMENTS OF EDUCATION PROCESS

- Periodic assessments of patients' exchange technique and problem solving.
- Tracking outcomes such as time to first peritonitis and exit site infection, hospitalization rate and causes.

INSTITUTE Peritoneal Dialysis Patient Training

Objective: To minimize the training burden on the patient and to improve the quality of training. By burden we refer to the amount of knowledge being given to the patient in a limited span of time.

By having a focused training program for 5 days concentrating purely on the practical aspects of PD, we will be able to have effective & retainable knowledge transfer, which the patient will further use for his benefit.

Every day before start of session, provide time for Q & A and revising previous day's session

PD Patient Day Wise Initial Training Schedule

Day of training	Theory	Practical	Hand out / information sheet	What to collect from patient/ patient assessment	Aim of the days training
Day 01	1. Home environment 2. Six steps Hand wash 3. Familiarize common terms in PD 4. Record maintenance	1. All exchanges & dressing done by PD NURSE, observed by Patient/caregiver 2. Record entered by PD NURSE	1. Training manual 2. Six Steps Hand wash LBL 3. Demo call to RHC 4. Next day plan	1. Pt summarizes reg home environment & perform 6 step hand wash 2. Care giver agreement	1. Build relation & interest on PD. 2. Understand the significance of & learn to Perfection: six step Hand wash
Day 02	1. Exchange Procedure 2. Exit Site Care	1. All exchanges by PD NURSE observed by patient/caregiver 2. Record entered by Pt/CG 4. Pt/CG does 6 step Hand wash	1. Exit site care & dressing 2. Next day plan 3. Infection control LBL 4. Autoclaving LBL	1. Perform 6 steps hand wash 2. Test on common terms in PD (verbal assessment) 3. Explains Exchange procedure &	1. Significance of record keeping & Entering values in records 2. ease patient into training 3. Patient is

		5. Exchange under observation of PD nurse		Dressing 4. Enters all values in the record	able to visualize the exchange procedure and recollect it step wise. (build confidence)
Day 03	1. Exchange Procedure 2. Exit Site Care 3. Infectious complications of PD 4. Autoclaving	<ul style="list-style-type: none"> 1 exchange by PD NURSE 2 exchanges by pt/CG 	1. Fluid Balance LBL 2. Next day plan	1. Perform Exchange, Dressing & enters record 2. Summarizes about infection control & autoclaving	1. Pt/CG should be able to perform Exchange procedure & dressing 2. Significance of infection control 3. Discharge Plan with Nephrologist and intimate PT & Home visit CC
Day 04	1. Exit site care 2. Infectious complications of PD 3. IP medications Fluid Balance & Diet basic concepts <ul style="list-style-type: none"> how to calculate fluid intake Symptoms of fluid overload 	<ul style="list-style-type: none"> All Exchanges & dressing done by Pt/CG All record keeping be done by patient IP Medications 	IP medication LBL	1. Exchange procedure, Dressing & all other activities related to PD done by Pt/CG 2. measuring fluid (UF, UO & Intake & approximate measure of common water glasses)	1. Build confidence on him/herself 2. Prepare for self care
Day 05	<ul style="list-style-type: none"> Importance of a proper diet plan <ul style="list-style-type: none"> salt & protein intake Medications <ul style="list-style-type: none"> EPO BP Meds 	<ul style="list-style-type: none"> All Exchanges done by Pt/CG 1 Exchange to be observed by Nephrologist / resident Recording BP / weight 	1. Ten Commandments Training completion call to RHC from patient bedside by PD NURSE.	1. Exchange procedure/ dressing/ record keeping/ 2. 2. Test on PD and certification from Hospital	1.Nephrologist is satisfied with quality of training imparted and this adds to confidence of patient 2. Patient is

	<ul style="list-style-type: none"> ○ PO₄ binders • Importance of regular hospital visits • Ordering supplies & stocking at home. <p>Revision & QA</p>	taking/			<p>prepared for Independent PD life outside hospital</p> <p>3. Pt discharged with advice on Follow up visit & labs, Stocking and ordering supplies and PD unit contact details. Also intimate patients stock supply only on Fresh Dr. Prescription</p>
--	---	---------	--	--	--

By the end of this training, the patient & care giver must be very confident on the Practical aspects of PD i.e:

- Taking weight
- Measuring UO , UF
- Record keeping
- Exchange procedure Dressing & Exit site care
- IP medication
- Recognizing signs and symptoms of Infectious complications of PD
- Must have a fair idea of diet/salt restriction
- Must know how to calculate fluid intake.

By the end of this training, the patient and caregiver must understand the significance of:

- Following correct technique
- Not frequently changing care giver and in case of change to inform PD Unit for retraining
- Fluid Balance & Diet
- Regular Hospital Visits and follow up investigations
- His / her participation in the treatment

PD PATIENT TRAINING CHECKLIST

- Patient understands and accepts chronic nature of disease and need for dialysis: Yes ☐ No ☐
- Training done in Hospital : Yes ☐ No ☐
- Training done by hospital PD Nurse : Yes ☐ No ☐
- Complete 5 day training Protocol followed: Yes ☐ No ☐
- Post Training assessment (including inspection of 1 exchange by Doctor) done: Yes ☐ No ☐
- Patient Does proper exchange procedure: Yes ☐ No ☐
- Patient does proper Exit site care : Yes ☐ No ☐
- Patient Understands significance of Compliance to
 - PD Prescription: Yes ☐ No ☐
 - Record Keeping : Yes ☐ No ☐
 - Other medications: Yes ☐ No ☐
 - Aseptic Exchange Procedure: Yes ☐ No ☐
 - Clinic Visits : Yes ☐ No ☐
- Patient understands signs and symptoms of
 - Peritonitis: Yes ☐ No ☐
 - Exit Site Infection: Yes ☐ No ☐
 - Tunnel Infection : Yes ☐ No ☐
 - Fluid Overload: Yes ☐ No ☐
 - Dehydration: Yes ☐ No ☐
- Patient understands what to do in case of
 - Peritonitis: Yes ☐ No ☐
 - Exit Site Infection: Yes ☐ No ☐
 - Tunnel Infection : Yes ☐ No ☐
 - Fluid Overload: Yes ☐ No ☐
 - Dehydration: Yes ☐ No ☐
- Patient recognizes and knows what to do in case of
 - Common problems during exchange (drainage problems) Yes ☐ No ☐
 - Other complications (constipation, pain): Yes ☐ No ☐
 - Contamination: Yes ☐ No ☐
- Patient knows
 - How to heat the bag: Yes ☐ No ☐
 - Importance of diet and proteins in diet: Yes ☐ No ☐
 - Emergency contact numbers: Yes ☐ No ☐
 - Investigation schedule: Yes ☐ No ☐
 - Clinic Visit Schedule: Yes ☐ No ☐
 - How to order supplies: Yes ☐ No ☐
- You certify the patient is adequately trained: Yes ☐ No ☐
- Patient knows the need of transfer set change in every 4th month: Yes ☐ No ☐
- Patient has all emergency contact Nos: Yes ☐ No ☐

RATIONALE

The objectives for any dialysis treatment are to remove excess fluid and accumulated waste products or uraemic toxins.³ The CANUSA study⁴ demonstrated that total (renal and peritoneal) solute clearance was found to be closely correlated with poor outcomes including death. The results showed that there was a 6% reduction in the relative risk of death for an increase of 0.1 unit of Kt/V_{urea} . Similarly, an increase in 5L/1.73m² body surface area (BSA) of creatinine clearance per week was associated with a 7% decrease in the relative risk of death.

These results then led to the development of recommended practice guidelines by the National Kidney Foundation Dialysis Outcomes Quality Initiative (DOQI)⁵ on the minimum dose for adequate CAPD: a Kt/V_{urea} of 2.0 per week and a creatinine clearance of 60L/week/1.73m²

Reanalysis of the CANUSA Study⁹ and other prospective observational studies^{7-8,10}, showed that Residual Renal Function (RRF) measured by renal clearance or urine volume rather than peritoneal clearance, was associated with improved survival. The reanalysis of the CANUSA Study was subsequently supported by the prospective randomized Adequacy of PD in Mexico (ADEMEX)⁶. Hence adequacy targets for dialysis should include both urea and fluid removal³ (Evidence level C)

The National Kidney Foundation published their revised clinical practice guidelines for peritoneal dialysis adequacy in 2006¹. The minimal “delivered dose” of total small solute clearance (peritoneal and kidney) Kt/V_{urea} of at least 1.7 per week in patients with or without RRF. Some guidelines also require Cr. clearance targets to be met (Table 1). A retrospective study¹¹ from Hong Kong showed that anuric patients had better survival with peritoneal Kt/V_{urea} between 1.67-1.87 than patients with peritoneal Kt/V_{urea} of less than 1.67.

ISPD in 2006¹² based on the summary listing of findings from expert opinion and publications, strongly recommends that adequacy of dialysis should include both clinical and laboratory assessments. These include peritoneal and renal clearance, hydration status, nutritional status, energy level, haemoglobin concentration, electrolytes and acid base balance, calcium and phosphate intake and blood pressure control. A continuous PD regimen is preferred to intermittent dialysis. Patients should be closely monitored for signs and symptoms of under dialysis and fluid overload so that the PD prescription could be adjusted in a timely manner.

Attention should be paid to both urine volume and ultrafiltration with the goal of maintaining euvolaemia. Mujais et al¹³ in 2000 published guidelines on evaluating and management of ultrafiltration problems in PD. This was followed by Abu-Alfa et al² in 2002 who described a practical approach to fluid management to achieve normotension in PD patients with minimal use of antihypertensive medications.

	Total Kt/V (per week)	Total CrCl (per week)	Continuous treatment	UF (per day)
KDOQI(2006)	≥ 1.7	NR	Yes	NR
ISPD (2006)	≥ 1.7	APD >45L/week	Yes	NR
Canada (2003)	≥ 1.7	NR	NR	NR
European Best Practice Guidelines (2005)	≥ 1.7	APD>45L/week for patients with frequent short exchanges and slow transport status	NR	1.0L/24hr
CARI Guidelines (Australia)(2005)	≥ 1.6	High/high average transporters >60L/week Low/Low average transporters>50L/week	NR	NR
UK Renal Association(2007)	≥ 1.7	$\geq 50\text{L/wk}$	NR	$\geq 750\text{ml/24hr}$
Indian Guideline (2008)	≥ 1.7	$\geq 45\text{L/wk}$	Yes (anuric patients)	NR

Adequacy targets and recommendations

No	Peritoneal Adequacy Target Guidelines ^{1,3,12}	√
1.	Adequacy of dialysis targets should include clinical assessments in addition to solute and fluid removal targets	
2.	The total (peritoneal and renal)Kt/V _{urea} should be at least 1.7	
3.	Some guidelines also require Cr Clearance targets to be met.	
4.	Kt/V _{urea} should be measured <ul style="list-style-type: none"> • within 1st month after initiating dialysis and • at least once every 4 months thereafter for all PD patients • 1 month after a peritonitis episode 	
5.	A 24hr urine collection for volume and solute clearance is recommended at a minimum every 2 months for patients with urine volume >100mls/24 hours	

No	Peritoneal Dialysis Prescription Guidelines ¹	√
1.	PD prescription should be adjusted if <ul style="list-style-type: none"> • a patient presents with signs and symptoms of under dialysis even though the Kt/V_{urea} is above the minimal target • there are any significant changes in the RRF 	
2.	A continuous PD regimen is preferred to intermittent dialysis in patients with minimal RRF	
3.	A baseline Peritoneal Equilibration Test (PET) is to be measured 4 to 8 months after initiating dialysis.	
4.	PET should be repeated 1 month after resolution of an episode of peritonitis and whenever clinically indicated	

No	Peritoneal Dialysis Prescription Guidelines ^{1,2}	√
1.	Patients' schedule and Quality of Life (QOL) should be taken into consideration when prescribing a PD therapy	
2.	Record of PD effluent volume should be reviewed monthly with particular attention to drain volume from the overnight dwell in CAPD and daytime dwell in APD	
3.	Use the lowest possible glucose concentration to achieve volume status. Drain volume should be optimized during the overnight dwell in CAPD and the daytime dwell in APD to maximize both solute clearance and UF volume	
4.	Implement dietary fluid and sodium restrictions when necessary	
5.	Hypertensive patients who show evidence of volume overload should generally not have negative UF for any daytime or nighttime exchanges	

No	Approach to fluid management ^{1,2,13}	√
1.	Monitor and review drain volume, RRF and patient's blood pressure on a monthly basis	
2.	Evaluate dialytic fluid removal paying particular attention to both long and short dwells.	
3.	Monitor for non compliance which may alter fluid balance. These include: <ul style="list-style-type: none"> • Non adherence to exchange spacing in CAPD • Therapy time in APD • Inappropriate use of glucose concentration • Excessive sodium and fluid intake 	
4.	Use of a therapeutic approach to for prevention of fluid overload problems. These include: <ul style="list-style-type: none"> • Routine monitoring of weight, RRF and UF • Dietary counseling • Use of diuretics including dose adjustments when required • Patient education emphasizing on recognizing signs and symptoms and consequences of fluid overload • Glycaemic control • Preservation of Peritoneal membrane function. These include <ul style="list-style-type: none"> ➤ Minimizing episodes of peritonitis ➤ Minimize the use of hypertonic solutions 	

INSTITUTE PD Adequacy protocols:

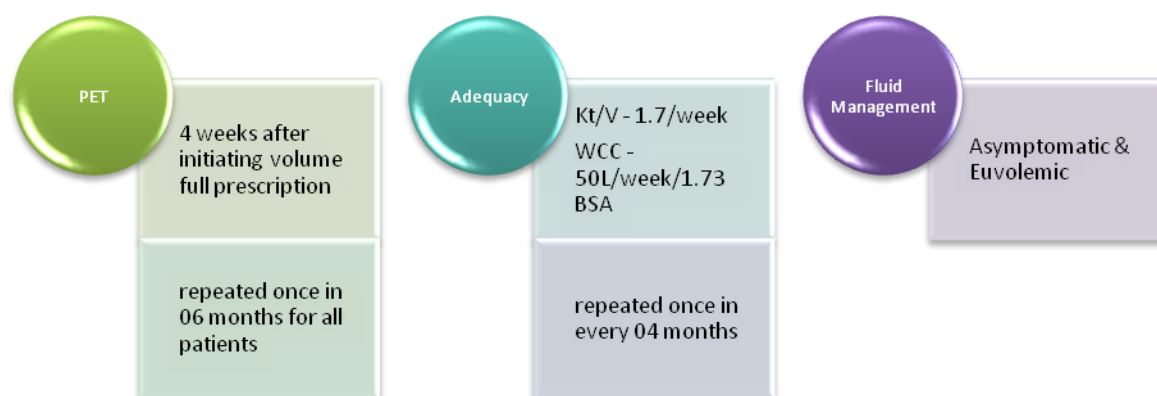
INSTITUTE PD Program will strive to optimize prescription to achieve the targets mentioned in Figure 1 below. The PD Adequacy software will be used for all patients to help optimize the prescriptions to reach the target clearances and fluid status. During patient follow up also the prescriptions shall be altered basis the clinical requirements and lab results

August and **September** of every year are declared as the PD adequacy months for the INSTITUTE PD Program, where every patient in the PD Program shall undergo the tests as outlined in the figure. Further in any patient with **≥ 100ml/24 hrs urine output, 24 hour urine collection shall be done once in 3 months for volume and solute clearance**

Further the unit shall adhere to the algorithms detailed below for prescribing PD while handling fluid and solute related problems.

Figure 1:

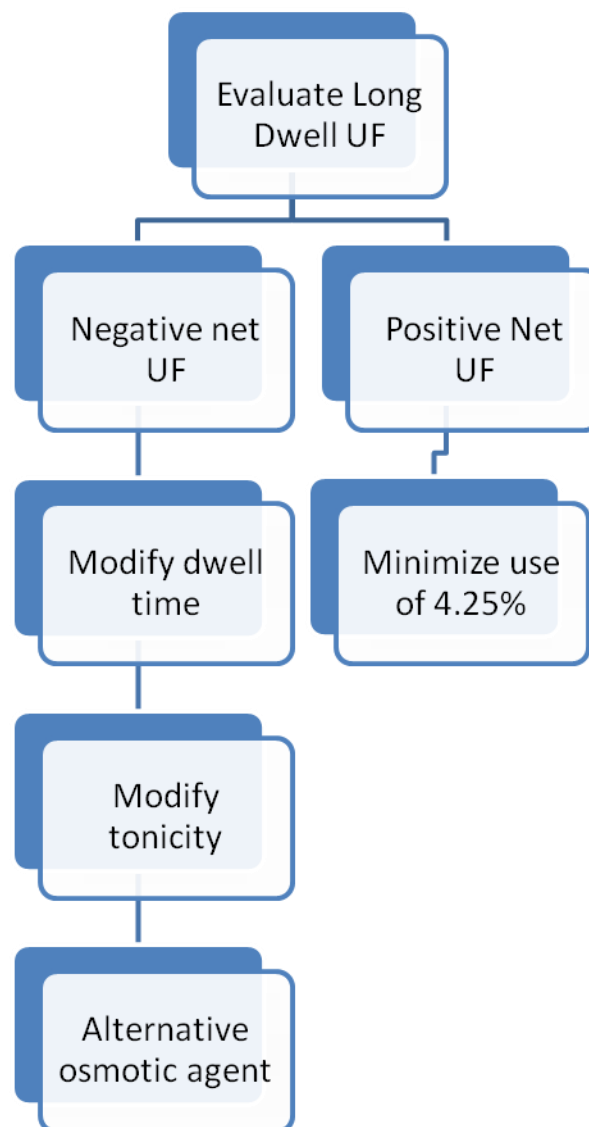
This figure details the time of initial PET and adequacy measurements for the patients in INSTITUTE PD Program. It also details the targets and frequency at which the same will be repeated to ensure adequate dialysis



Further to the frequency mentioned PET shall be performed 1 month after complete resolution of an episode of peritonitis and whenever there is any clinical indication and required prescription adjustments made along with testing adequacy of prescription.

Algorithm 1

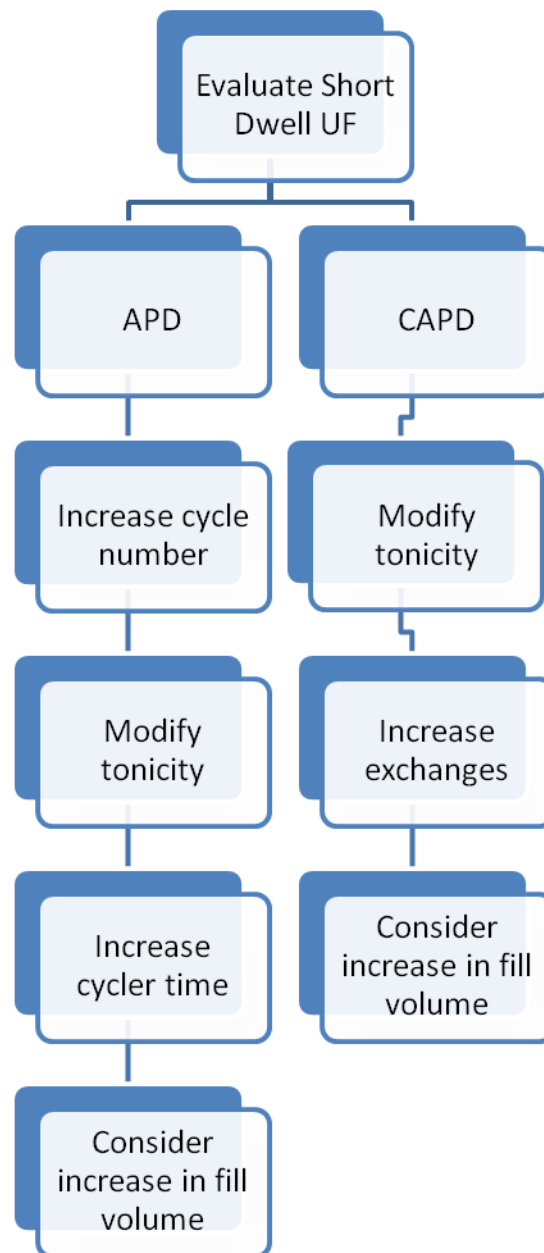
Algorithm for management of fluid removal in long dwell

**Reference:**

Abu-Alfa et al. Approach to fluid management in peritoneal dialysis: A practical algorithm. Kidney International 20002 (62) Supplement 81: S8-S16

Algorithm 2

Algorithm for management of fluid removal in short dwell

**Reference:**

Abu-Alfa et al. Approach to fluid management in peritoneal dialysis: A practical algorithm. Kidney International 20002 (62) Supplement 81: S8-S16

PET, ADEQUACY AND PD PRESCRIPTION CHECKLIST

- Institute advocates a minimum target of
 - 1.7 for KT/v: Yes ☐ No ☐
 - 45 l/week for Cr Clearance: Yes ☐ No ☐
- Patient baseline PET Done within 4 to 8 weeks of PD prescription: Yes ☐ No ☐
If No please provide rationale _____
- PET done
 - 1 month after resolution of peritonitis: Yes ☐ No ☐
 - As and when clinically indicated: Yes ☐ No ☐
 - Routinely every 6 months: Yes ☐ No ☐
- Patient baseline Adequacy (Kt/V & Cr Cl) done: Yes ☐ No ☐
- Adequacy done
 - After every 6 months: Yes ☐ No ☐
 - Renal clearance (if not anuric) done once in every 2 months: Yes ☐ No ☐
- Prescription adjusted to meet targets: Yes ☐ No ☐
- Lowest possible glucose concentration used: Yes ☐ No ☐
- Patient on continuous therapy: Yes ☐ No ☐
- Salt and water restrictions imposed: Yes ☐ No ☐
- Adequate BP control achieved: Yes ☐ No ☐
- Patient put on diuretics: Yes ☐ No ☐
- ACEI / RRB/ CCI used: Yes ☐ No ☐
- Adequate Glycemic control achieved: Yes ☐ No ☐

INSTITUTE PD PROGRAM: Management Guidelines for infectious complications of PD:**Introduction****PREVENTION, DIAGNOSIS AND TREATMENT OF PERITONITIS****Objective**

1. To reduce dropout related to peritonitis to < 20%.
2. To reduce peritonitis rates to 1 episode in ≥ 45 patient months.

Rationale

Infectious complications especially *peritonitis* continues to be a frequent complication in PD and accounts for a fair proportion of drop outs from a PD program.

Peritonitis remains a serious problem accounting for a high percentage of permanent transfer to haemodialysis (HD) and is contributing to mortality. Many of these peritonitis episodes are a result of contamination at the time of fluid exchange or exit site infections¹. There have been significant improvements in peritonitis rates over time. However, it remains the number one cause of PD technique failure in most of the countries.

In the United States, Mujais and Story² found that almost 30% of transfers to HD were due to infection (peritonitis and/or exit site infection). Similarly, in a nationwide survey³ in Japan regarding reasons for dropout from PD found that one third of the transfer were due to peritonitis.

According to the 2007 National Renal Registry in Malaysia⁴ peritonitis accounted for 40% of the transfer to HD.

Guidelines to prevent catheter related infections were first published by International Society of Peritoneal Dialysis (ISPD) in 1983 and has been revised numerous times. The latest update published in 2005⁵ focused on prevention of peritonitis. ISPD recommends that every programme should monitor their infection rates at a minimum on yearly basis as part of a continuous quality improvement programme. Although the ISPD recommends that the centres' peritonitis rates should be no more than 1 episode in every 18 patient months, many PD centres worldwide have reported very low infection rates (between 1 episode in 41-74 patient months).

Country	Peritonitis rates (episode/patient months)	Remarks
Japan	1:74	Imada A ⁶
Taiwan	1:62.1	Data from BNHI, Taiwan ⁹
Malaysia	1:40.9	NRR Malaysia 2007 ⁴
Hong Kong	1:27.7	HK Registry Report 2005 ⁷
US	1:32.7	Mujais ⁸
MMM	1:43	Based on center data

There are 3 main area of focus to reduce dropout related to peritonitis

- Peritonitis prevention
- Peritonitis diagnosis
- Peritonitis treatment

The following checklists highlight the important areas that need to be focused on.

No	Peritonitis Prevention	√
1.	Proper PD catheter insertion including antibiotic prophylaxis and immediate post operative care reduce the risk of infection ¹⁰	
2.	Treatment of exit site infection and catheter replacement if necessary ¹⁰	
3.	Identification of appropriate care giver or helper for training and appropriate training ¹¹	
4.	Prevention of peritonitis due to external contamination ¹⁰ <ul style="list-style-type: none"> • Adequate initial PD training includes teaching of patient on aseptic technique and understanding the concepts of contamination and infection • Contamination prevention protocols in place • Flush before fill procedure is used • Avoid spiking of bags 	

	<ul style="list-style-type: none"> • Anti fungal prophylaxis^{5,15} 	
5.	Routine evaluation of re training needs (patient knowledge and ability to perform procedures): at 6 months and \geq yearly thereafter	
6.	Retraining should be scheduled if patients are unable to perform or give $\geq 80\%$ correct answers to procedure related problems ¹³	
7.	Infection control policy in place to minimize recurrence <ul style="list-style-type: none"> • Ensure appropriate hand washing and complete drying • Ensure aseptic technique prior to and at bag or fluid exchanges¹⁰ • Area designated for exchange must be clean 	
8.	Prevention of peritonitis from other causes <ul style="list-style-type: none"> • Prophylaxis for procedures (dental, colonoscopy)⁵ • Avoidance of constipation⁵ 	
9.	Home visits provide an opportunity to evaluate the environment and the abilities of the patients or caregivers in performing the therapy ¹⁰⁻¹¹	
No Peritonitis Diagnosis (ISPD Guidelines and Recommendations 2005) ✓		
1.	PD patients presenting with cloudy effluent should presumed to have peritonitis.	
2.	PD nurse should send effluent sample to the laboratory for cell count with differential, Gram stain and culture including antibiotic sensitivity pattern to confirm diagnosis (Refer to Appendix A)	
3.	Dwell time should be at least 1-2 hours prior to collection if the abdomen is dry (Refer Appendix B)	
4.	PD effluent for culture must be obtained prior to administration of antibiotics	
5.	Specimen processing <ul style="list-style-type: none"> • Standard culture technique is to use blood culture bottles • Culture negative peritonitis should not be greater than 20% of episodes • Culturing the sediment after centrifuging 50ml of effluent is ideal for low culture negative results (Refer to Appendix C)	

No Peritonitis treatment (ISPD Guidelines and Recommendations 2005) ✓		
1.	Empiric antibiotics must cover both Gram positive and Gram negative organisms	
2.	Antibiotic therapy is initiated prior to the knowledge of the causative organism	

3.	Selection of antibiotics is dependent on the patient and program's history of micro-organisms and sensitivities (<i>Refer to ISPD Guidelines 2005 for recommended selection of antibiotics and dosing</i>)	
4.	Once culture and sensitivity results are known, appropriate antibiotic adjustments should be made	
5.	The length of treatment is determined mainly by clinical response. The ISPD Committee recommends a minimum 2 week antibiotic therapy for treatment of peritonitis. For severe infections, 3 weeks is recommended	
6.	Intra peritoneal dosing of standard antibiotics is the preferred route of administration for treatment of peritonitis	
7.	Consider catheter removal for <ul style="list-style-type: none"> relapsing peritonitis refractory peritonitis fungal peritonitis refractory exit site and tunnel infection 	

Continuous Quality Improvement (CQI)

Monitoring peritonitis rate and identifying contributing factors is essential in a PD programme¹⁴. For each peritonitis episode, a root cause analysis should be done to examine the etiology of the infection. This is to prevent recurrence of the problem.

Calculation of peritonitis rate¹⁶

The most accurate peritonitis rate is one that is cumulative over a period of 12 months. Peritonitis rates are usually reported in 1 episode per x patient months.

Sample calculation

Calculation for peritonitis and exit-site rates (Annual cumulative patient days).

Peritonitis incidence:

- Number of days of patients' time on PD: Sum up the actual number of days each patient has been on the therapy since the beginning of the year.

For example: A programme has 10 patients on January 1, 2009. If no new patients started during that month and there were no dropouts, the month of January then accounts for 10 x 31 days = 310 days of PD treatment.

If a new patient starts on February 2, 2009, at the end of February there will be

- the original **310** days plus
- 10 (existing patients) x 28 days for the month = **280** days,

- + 1 patient with **27** days (new patient) giving a total of **617** days.

Take the 617 days and convert it to patient months by dividing by 30.42* = $617/30.42 = 20.28$ patient months

**30.42 is the average number of days per month and it is a standard used in infection rate calculations*

- Divide the patient months by the number of episodes of peritonitis experienced by the total group of 11 patients i.e. 20.28 patient months/two episodes of peritonitis = one episode of peritonitis every 10.14 patient months.
- For a single centre, it is not meaningful to calculate incidence of peritonitis > once per year.

Recommended Evaluations

1. Track peritonitis rate annually.
2. Chart trends of causative organism by month or by quarter.
3. Monthly meetings to explore root causes of each infection and plan for intervention to prevent recurrence.
4. Re-evaluate the peritonitis treatment protocol of the PD programme .

References

1. Piraino B. Peritoneal Dialysis Infections Recommendations. *Contributions in Nephrology* 2006;150):181-186
2. Mujais S and Story K. Peritoneal dialysis in the US: Evaluation of outcomes in contemporary cohorts. *Kidney Int.* 2006;Nov; (103):S21-26
3. Kawaguchi Y et al. Study group for withdrawal from PD in Japan. Searching for reasons for dropout from peritoneal dialysis: a nationwide survey. *Perit Dial Int.* 2003;23(Suppl 2): S175-177
4. 15th Report of the Malaysian Dialysis and Transplant Registry 2007.
5. Piraino B et al. ISPD Guidelines/Recommendations: Peritoneal Dialysis Related Infections Recommendations:2005 update. *Perit Dia Int.* 2005;25; 107-131
6. Imada A. A multicenter study on CAPD related infection in Japan. Abstract in *Perit Dial Int* 2006;Suppl 2:S54
7. Ho YW et al. Hong Kong Registry Report 2004. *Hong Kong J Nephrol* 2005;7(1):38–46
8. Mujais S. Microbiology and outcomes of peritonitis in North America. *Kidney Int.* 2006; (70): S55-S62
9. Dialysis Global Budget Quality Report 2008 published on Bureau of National Health Insurance Taiwan website.
http://www.nhi.gov.tw/webdata/webdata.asp?menu=1&menu_id=7&webdata_id=818
10. Bender et al. Prevention of infectious complications in peritoneal dialysis: best demonstrated practices. *Kidney Int.* 2006;(70):S44-S54
11. Bernadini et al. ISPD guidelines/Recommendations: Peritoneal Dialysis Training, 2006. *Perit Dial Int* 2006; 26(6): 625-632
12. Hall et al. New Directions in Peritoneal Dialysis Patient Training. *Nephrology Nursing Journal* 2004;31(2):149-163
13. Russo et al, Patient retraining in Peritoneal Dialysis: Why and when it is needed? *Kidney Int.* 2006: (70): S127-S132
14. Alacraz M et al. Decreasing Peritonitis Rates Infection. *Nephrology Nursing Journal* 2008; (35) No 4: 421-423
15. Wong PN et al. Prevention of fungal peritonitis with nystatin prophylaxis in patients receiving CAPD. *Perit Dial Int* 2007; 27(5):531-536
16. Baxter Access Care and Complications Management: Care of the adult on Peritoneal Dialysis 2006

INSTITUTE PD PROGRAM: Infectious complications Protocols**Diagnosis:**

Sampling Technique:

Steps

- a. Clamp the patient connector line of the Ultrabag/Twin Bag with the ultra clamp or the short nose for outlet port clamp.
- b. Transfer the effluent from the drain bag into the supply bag.
- c. Thoroughly mix the effluent in the supply bag and collect a sample as needed.

Procedure

1. Place the supply bag on a flat surface.
2. Wash your hands thoroughly.
3. Put on a pair of sterile gloves (if you are obtaining a culture specimen).
4. Using a povidone iodine swab, place a drop of povidone iodine on the medication port and soak for 5 minutes.
5. Use a sterile piece of gauze pad to absorb any excess Povidone Iodine from the medication port.
6. Insert a syringe with needle attached into the centre of the medication port and withdraw your sample.
7. Remove your syringe and needle from the medication port.
8. Inject your sample into the collection container. If you are obtaining the sample for a culture/sensitivity, please change needles prior to injecting into the culture container.
9. Label the sample appropriately and send it to the laboratory.

Diagnosis:

Specimen Processing

1. Cultures should be obtained as early as possible.
2. The first bag of cloudy solution is the best specimen.
3. Samples should be sent and analyzed within 24 hours.
4. A large volume (50 ml) is needed for culture. This is to maximize bacterial recovery rates.
5. Centrifugation of 50ml of effluent at 3000rpm for 15 minutes, followed by re suspension of the sediment in 3-5ml of sterile saline and inoculation of the material both on solid culture media and into standard blood culture medium is the most ideal method to result in a culture negative rate of <5%.
6. If the equipment for centrifuging large amounts of fluid is not available, the effluent may be injected into a blood culture bottles (5-10mls per bottle).
7. Culture negative peritonitis should not be greater than 20% of episodes.
8. The collection and processing of specimens require meticulous care in order to avoid contamination of the fluid.
9. Laboratory must be notified of specimens obtained from patients receiving antibiotics.

References:

1. ISPD guidelines/Recommendations, Peritoneal Dialysis-Related Infections Recommendations:2005 update Perit Dial Int. 2005 (25);107-131.
2. Baxter Access Care and Complications Management: Care of the adult on Peritoneal Dialysis 2006.
3. Baxter Clinical Process for Optimal Outcomes 2007: Sample collection method from the Peritoneal Equilibration Test.

Peritoneal Effluent Culture Laboratory Processing

(2005 ISPD Guidelines)

Procedure:

- Centrifuge 50 ml 6 tubes of peritoneal effluent at 3000 g for 15 minutes. Discard the supernatant.
- Follow with resuspension of the sediment in 3–5 ml of sterile saline.
- Inoculate this material both on solid culture media such as 5% sheep blood agar, Chocolate agar, MacConkey agar, Sabarauds dextrose agar and into Thioglycollate broth, Brain heart infusion broth and Sabarauds dextrose broth and into a standard blood-culture medium (BacT alert anaerobic bottle) (method most likely to identify the causative organisms. With this method, less than 5% will be culture negative).
- The solid media should be incubated in aerobic, microaerophilic and anaerobic environments. (5% Carbon dioxide incubator).
- Blood-culture bottles can be directly injected with 5–10 mL of effluent if equipment for centrifuging large amounts of fluid is not available (this method generally results in a culture-negative rate of 20%).
- The removal of antibiotics present in the specimen may increase the isolation rate if the patient is already on antibiotics. . Automated blood culture bottles contain resins which neutralize antibiotics if given to patients.

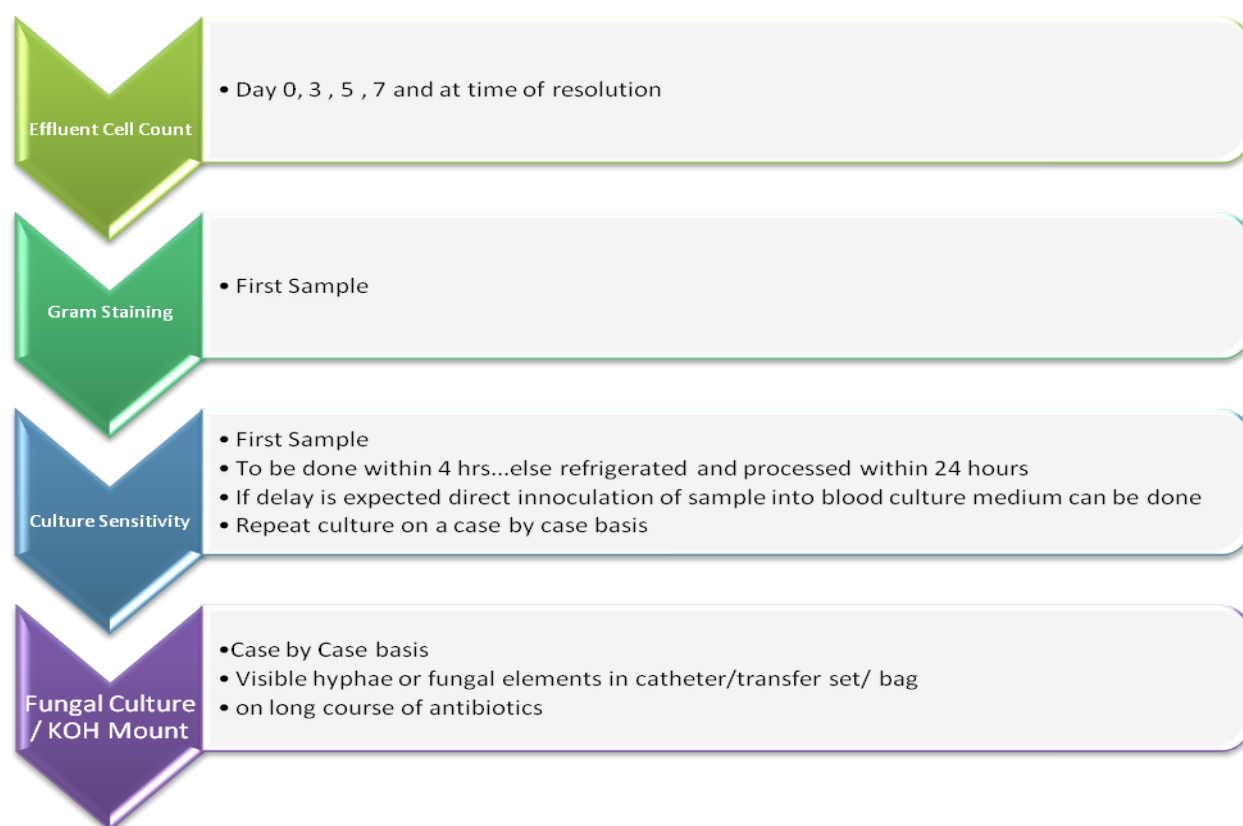
Important Points:

- The speed with which bacteriological diagnosis can be established is very important.
- Concentration methods not only facilitate correct microbial identification, but also reduce the time necessary for bacteriological cultures.
- Rapid blood-culture techniques (e.g., BACTEC, Septi-Chek, BacT/Alert; Becton Dickinson) may further speed up isolation and identification.
- The majority of cultures will become positive after the first 24 hours and, in over 75% of cases, diagnosis can be established in less than 3 days.

Mycobacterium Examination:

- Examine smear of the peritoneal effluent with the Ziehl-Neelsen stain (“smear negative” disease is common).
- The sensitivity of the smear examination by the Ziehl-Neelsen technique can be enhanced by centrifuging 100–150 ml of the dialysate sample.
- Prepare smear from the pellet.
- A specific diagnosis can be made by culturing the sediment, after centrifugation of a large volume of effluent (50–100 ml), using a solid medium (such as Lowenstein-Jensen agar) and a fluid medium (Septi-Chek, BacT/alert; bioMerieux, BACTEC; Becton Dickinson; etc.)
- The time of detection for growth of mycobacteria is decreased considerably in fluid medium.
- Repeat microscopic smear examination and culture of dialysis effluent is mandatory for better yield in suspected cases of mycobacterial peritonitis.
 - PCR may best help diagnose tubercular peritonitis.

Frequency of Laboratory Investigations



Management:

Nursing Protocol

1. The patient may present with signs and symptoms of peritonitis:
 - a. Cloudy effluent
 - b. Abdominal pain
 - c. Unexplained fever
2. Clinical diagnosis

A combination of 2 out of 3 of the following criteria may be indicative of the presence of peritonitis

- a. Cloudy effluent with WBC $>100/\text{mm}^3$ of which 50% are polymorphonuclear neutrophils (PMN).
- b. Abdominal pain.

- c. Identification of organisms on Gram stain or culture.
3. The patient is instructed to bring in the first cloudy effluent bag to the PD center.
4. APD patients without a daytime exchange who present with abdominal pain during the day may have no fluid to withdraw.

–Infuse 1 L of dialysate for a minimum of 1–2 hours; examine for turbidity and send for cell count with differential and culture.
5. Obtain sample from the cloudy effluent bag for testing of:
 - a. Cell count / differential count
 - b. Gram stain
 - c. Culture and sensitivity
6. In the presence of cloudy effluent with pain and/or fever perform 2-3 rapid exchanges with Dianeal to relieve discomfort.
7. Check with the patient and his/her medical records to note any drug allergy.
8. If there is no known drug allergy – Administer first line Empiric Antibiotic Therapy as per unit protocol or ISPD Peritonitis Antibiotic recommendation – 2005 Update.
9. If necessary adjust antibiotics based on culture and sensitivity results.
10. In the presence of cloudy effluent add heparin 500 to 1000u/L to a new bag till effluent clears (usually 48-72 hours) [as per hospital protocol].
11. Send PD fluid for cell count till clear and then 3 days after (as per hospital's protocol).
12. Send PD effluent for cell count and culture and sensitivity after completion of antibiotic treatment.

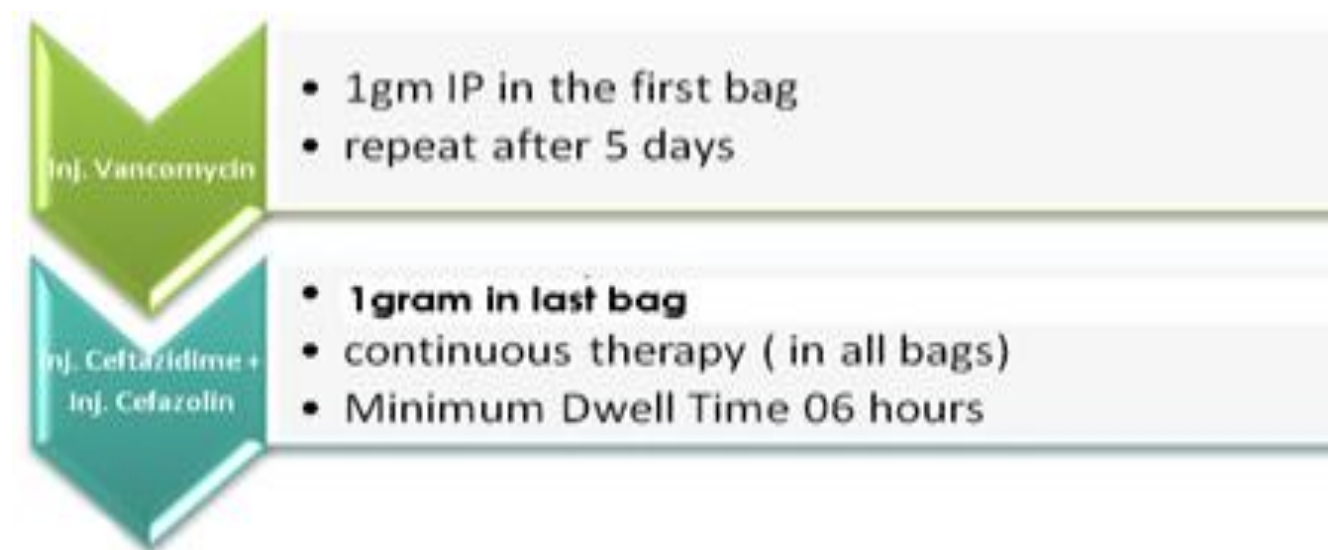
Reference:

Li et al. ISPD Guidelines/ recommendations. Peritoneal Dialysis-Related Infections Recommendations: 2010 Update. Peritoneal Dialysis International, Vol. 30, 2010.

Medication Protocol

Empiric Antibiotic Selection for Treatment of Peritonitis

- ☀ Administer antibiotics through IP route (it is considered better for treating peritonitis compared to I.V. dosing and both continuous and intermittent administration are equally effective)
- ☀ Antibiotic therapy to be started before the identification of causative pathogen, followed by appropriate use based on the culture sensitivity.
- ☀ Empiric agents selected to cover all serious pathogens.

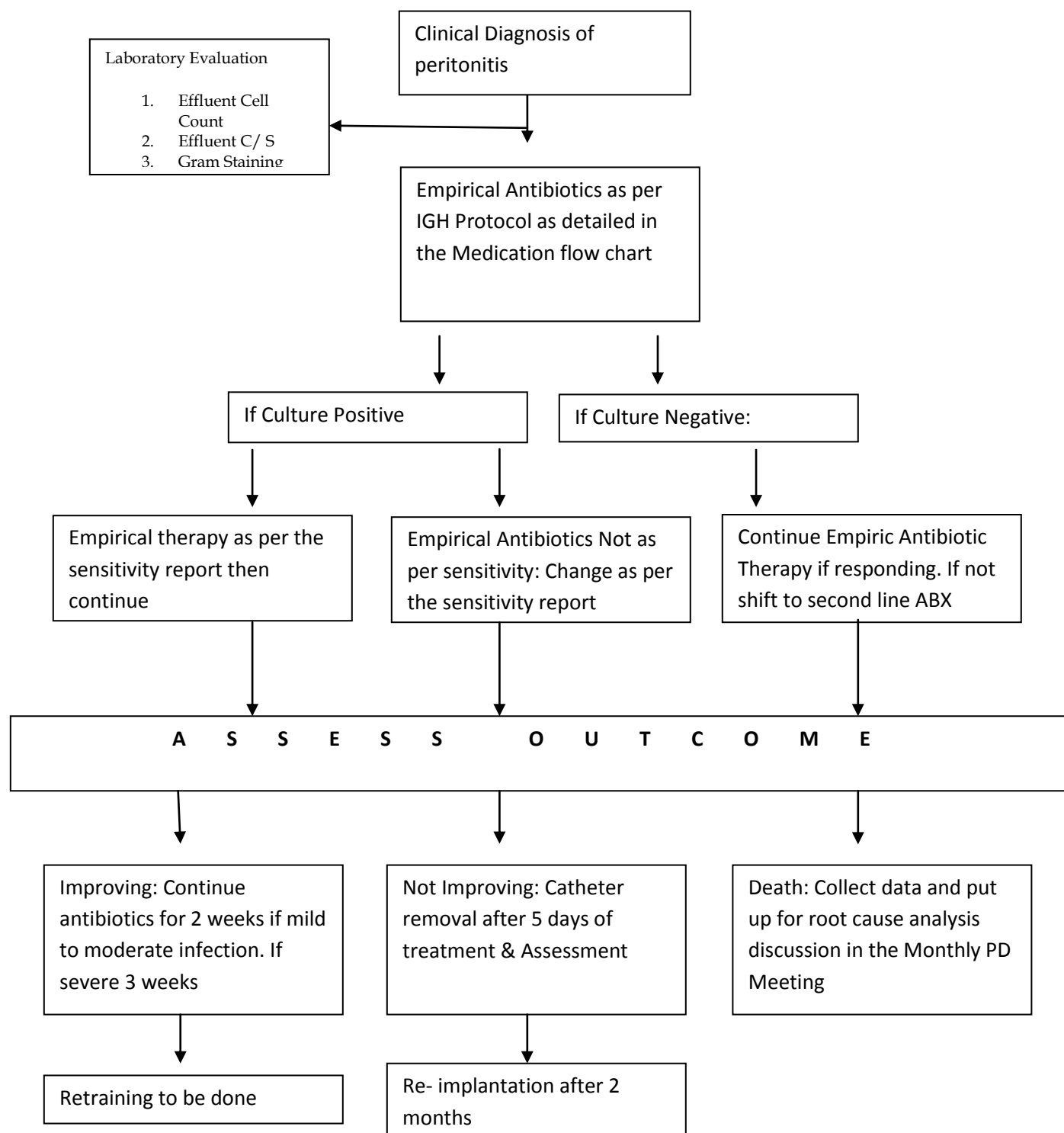


Vancomycin can be considered for treatment of methicillin resistant *S. aureus* while an aminoglycoside or a third generation cephalosporin can be used for Gram-negative organisms.

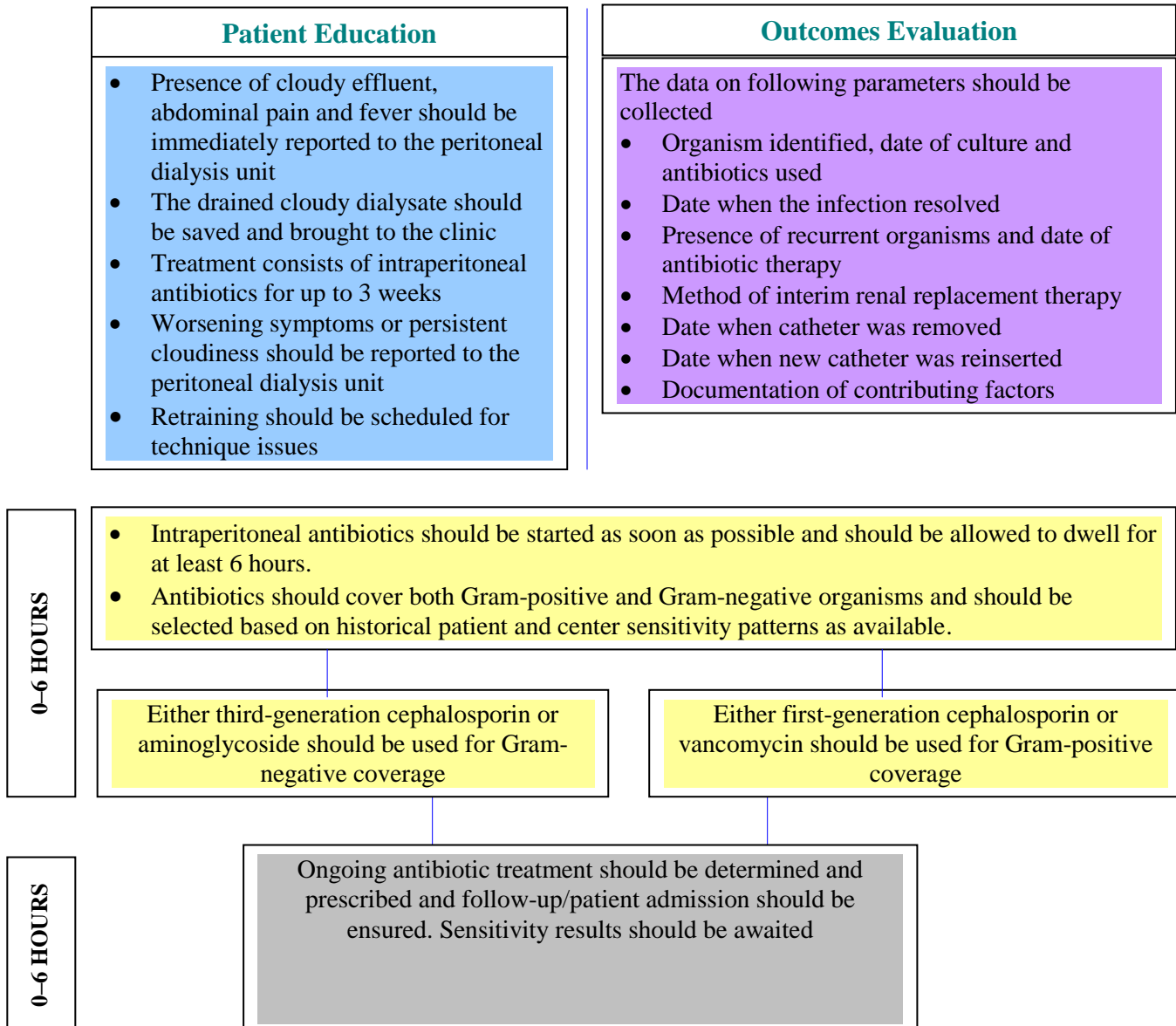
- Prophylactic local application in Exit Site Infection of Mupirocin cream depending on Gram Staining
- Empirical treatment of active Tunnel / Exit Site infection with :

Amino quinolones + Cefdinir

Medication Protocols



Catheter removal Indications: 1) Refractory Peritonitis 2) Relapsing Peritonitis 3) Fungal Peritonitis 4) Relapsing Exit site / tunnel infection



Flowchart for management of peritonitis

- ✱ A first-generation cephalosporin like cefazolin/ cephalothin with another agent for broader Gram-negative coverage (including activity against *Pseudomonas*) will be appropriate in most cases and has been shown to be equivalent to combination therapy with vancomycin for Gram-negative coverage.
- ✱ Aminoglycosides, cephalosporins and carbapenem provides adequate Gram-negative coverage but quinolones should be used only if local sensitivities support their use for empiric Gram-negative cover.
- ✱ Aztreonam is indicated in patients who have cephalosporin allergy.
- ✱ The use of extended-spectrum antibiotics can lead to the development of resistance. Careful monitoring is essential especially for *Enterococci*, *Staphylococci*, yeasts, and Gram-negative organisms like *Pseudomonas*, *E. coli*, *Proteus*, *Providencia*, *Serratia*, *Klebsiella* and *Enterobacter* species to prevent emergence of resistance.

- ✱ Short-term use of aminoglycosides can be considered since their extended use has been associated with increased risk for both ototoxicity and vestibular toxicity. Intermittent dosing is strongly recommended for use of aminoglycoside for initial Gram-negative coverage.
- ✱ Cefepime can be used for Gram-negative coverage as it is not degraded by β -lactamases and has better activity than ceftazidime.
- ✱ Administration of systemic vancomycin along with ciprofloxacin may also be considered as an effective first-line antibiotic therapy. Sufficient levels of quinolones are seen within the peritoneum, even in patients on cycler PD and so these can be considered as a suitable alternative to aminoglycosides for Gram-negative coverage.

Continuous or Intermittent Dosing of Antibiotics

Continuous or once-daily intermittent dosing of antibiotics can be given by IP route in each exchange. To allow adequate systemic absorption, antibiotic-containing dialysis solution during intermittent dosing should be left undisturbed for at least 6 hours. An enhanced absorption of most of the antibiotics is often seen during peritonitis. The doses of antibiotics for both continuous and intermittent administration for CAPD are given in Table below.

Antibiotic Class	Intermittent (per exchange, once daily)	Continuous (mg/L; all exchanges)
Cephalosporins		
Cefazolin, cephalothin, orcephradine	15 mg/kg	LD500, MD125
Cefepime	1000 mg	LD500, MD125
Ceftazidime	1000-1500 mg	LD500, MD125
Ceftizoxime	1000 mg	LD250, MD125
Aminoglycosides		
Amikacin	2 mg/kg	LD25, MD12
Gentamicin, netilmicin, ortobramycin	0.6mg/kg	LD8, MD4
Quinolones		
Ciprofloxacin	ND	LD50, MD25
Penicillins		
Amoxicillin	ND	LD 250-500, MD 50
Ampicillin, oxacillin, or nafcillin	ND	MD125
Azlocillin	ND	LD500, MD250
Penicillin G	ND	LD 50000 units, MD 25000 units
Other Antibiotics		
Aztreonam	ND	LD 1000, MD 250
Daptomycin	ND	LD100, MD20
Linezolid	Oral 200-300 mg/q.d.	
Teicoplanin	15 mg/kg	LD400, MD20
Vancomycin	15-30 mg/kg every 5-7 days	LD1000, MD25
Antifungals		
Amphotericin	NA	1.5
Fluconazole	200 mg IP every 24-48 hours	

Combinations		
Ampicillin/sulbactam	2 g every 12 hours	LD 1000, MD 100
Imipenem/cilastin	1 g b.i.d.	LD250, MD50
Quinupristin/dalfopristin	25 mg/Lin alternate bags ^b	
Trimethoprim/sulfamethoxazole	Oral 960mg b.i.d.	
ND = no data; q.d. = every day; NA = not applicable; IP = intraperitoneal; b.i.d. = 2 times per day; LD = loading dose in mg/L; MD = maintenance dose in mg/L.		

Doses for continuous and intermittent administration for CAPD patients

Intermittent dosing of aminoglycosides and vancomycin has been shown to be efficacious in CAPD but not in APD. An adequate 24-hour level of antibiotics like cefazolin is maintained during once-daily IP administration in CAPD patients. The intermittent dosing of antibiotics and the recommendations of their use in APD is given in table below.

Drug	Intraperitoneal Dose
Tobramycin	Loading dose of 1.5 mg/kg IP in long dwell, followed by 0.5 mg/kg IP each day in long dwell
Cefazolin	20 mg/kg IP every day, in long day dwell
Cefepime	1g IP in 1 exchange per day
Fluconazole	200 mg IP in 1 exchange per day every 24–48 hours
Vancomycin	LD 30 mg/kg IP in long dwell; repeat dosing 15 mg/kg IP in long dwell every 3–5 days (aim to keep serum trough levels above 15 µg/mL)
IP = intraperitoneal; LD = loading dose.	

Intermittent dosing of antibiotics in Automated Peritoneal Dialysis

Rapid exchanges seen in APD can cause insufficient time to reach IP levels.

Reference: Li et al. ISPD Guidelines/ recommendations. Peritoneal Dialysis-Related Infections Recommendations: 2010 Update. Peritoneal Dialysis International, Vol. 30, 2010.

PERITONITIS PREVENTION CHECKLIST

- Patient /Care giver motivation to perform procedures assessed t
 - Yes ☐ No ☐
- Home Environment assessed (home visit / verbally from patient)
 - Yes ☐ No ☐
- Pre operative antibiotics given as per center protocol
 - Yes ☐ No ☐
- PD Catheter inserted by
 - Surgeon ☐ Nephrologist ☐
- PD Catheterization Technique
 - Open ☐ Percutaneous ☐ Laparoscopic ☐ Peritoneoscopic ☐
- Break In period given
 - < 3 days ☐ 3 – 7 days ☐ 7 – 15 days ☐ 15 days ☐
 - Please mention exact days here _____
 - Reason for immediate start if that is the case _____
- Adequate PD training given
 - Yes ☐ No ☐
- Training given in
 - Hospital ☐ Home ☐ other ☐
- Patient / Care giver assessed after training (especially on infection prevention)
 - Yes ☐ No ☐
- In case of hospitalization due to peritonitis:
 - Re – evaluation of training done once in 06 months
 - Yes ☐ No ☐
 - H/O any immediately preceding invasive procedures
 - Yes ☐ No ☐
 - H/O break in technique (please corroborate history by checking exchange procedure)
 - Yes ☐ No ☐
 - H/O constipation
 - Yes ☐ No ☐
 - Catheter removal done
 - Yes ☐ No ☐
 - Peritonitis outcomes
 - In 5 days ☐ 5 – 10 days ☐ 10 – 15 days ☐ > 15 days ☐
 - Peritonitis outcomes
 - Resolved ☐ Transfer to HD ☐ Death ☐ Other ☐
 - Retrained before discharge
 - Yes ☐ No ☐
 - Patient counseled on importance of prevention of infections
 - Yes ☐ No ☐

PERITONITIS DIAGNOSIS CHECK LIST

- Sample Collection
 - 50 ml collected : Yes ☐ No ☐
 - Sample sent before administering Antibiotics : Yes ☐ No ☐
 - Microbiology informed of previous use of antibiotics and clinical course of episode: Yes ☐ No ☐
 - Sample sent within 4 hours: Yes ☐ No ☐
 - If delay in processing or transport, was sample refrigerated: Yes ☐ No ☐
 - Microbiology lab specimen follows(ISPD/PDSI) guidelines : Yes ☐ No ☐

(50 ml centrifuges @ 3000g for 15 min...sediment is re suspended in 3-5 ml of saline and this solution is cultured)
- Culture Yielded result : Yes ☐ No ☐

PERITONITIS MANAGEMENT

- Empiric Antibiotics cover both Gram positive and Negative organisms: Yes ☐ No ☐
- Antibiotic has been changed after obtaining C/S report : Yes ☐ No ☐
- If no please provide reason _____
- Length of Antibiotic Therapy : 1 week ☐ 2 week ☐ 3 week ☐ 4 week ☐
- Fungal Prophylaxis given : Yes ☐ No ☐
- Episode outcome: Resolved ☐ Transfer to HD ☐ Death ☐ Other ☐